CLAIMS

1. A process for producing a ceramic film on a substrate, said process comprising:

preparing a film-forming fluid comprising a ceramic precursor, a catalyst, a surfactant and solvent(s);

depositing said film-forming fluid on said substrate; and

removing said solvent(s) from said film-forming fluid on said substrate to produce said ceramic film on said substrate,

wherein said ceramic film has a dielectric constant below 2.3, and a metal content of less than 500 ppm.

2. The method of claim 1, wherein said dielectric constant is from 2.2 to 1.3.

3. The method of claim 1, wherein said halide content is less than 1 ppm.

4. The method of claim 3, wherein said halide content is less than 500 ppb and said metal content is less than 1 ppm.

5. The method of claim 1, wherein said metal content is less than 1 ppm.

6. The method of claim 1, wherein said metal content is less than 100 ppb.

7. The method of claim 1, wherein said ceramic precursor is selected from the group consisting of tetraethoxysilane, tetramethoxysilane, titanium (IV) isopropoxide, titanium (IV) methoxide and aluminum sec-butoxide.

8. The method of claim 1, wherein said catalyst is an organic acid and said film-forming fluid is free of mineral acid catalysts.

9. The method of claim 1, wherein said catalyst is selected from the group consisting of acetic acid, formic acid, glycolic acid, glyoxylic acid and oxalic acid.

10. The method of claim 1, wherein said surfactant is nonionic and said film-forming fluid is free of ionic surfactants.

11. The method of claim 1, wherein said surfactant is a block copolymer of ethylene oxide and propylene oxide.

12. The method of claim 1, wherein said surfactant is selected from the group consisting of block copolymers of ethylene oxide and propylene oxide and polyoxyethylene alkyl ethers.

13. The method of claim 1, wherein said surfactant is an ethoxylated acetylenic diol.

14. The method of claim 1, wherein said solvent is selected from the group consisting of methanol, isopropanol, isobutanol, ethanol and n-butanol.

15. The method of claim 1, wherein said solvent removing comprises spinning said substrate and calcining said ceramic film on said substrate.

16. The method of claim 1, wherein said film-forming fluid is a sol having a gelation time of at least 300 hours.

17. The method of claim 1, wherein said ceramic film has a porosity of about 50% to about 85%.

18. A ceramic film produced by the process of claim 1.

19. The ceramic film of claim 18, wherein said dielectric constant is from 2.2 to 1.3.

20. The ceramic film of claim 18, wherein said halide content is less than 500 ppb.

21. The ceramic film of claim 18, wherein said metal content is less than 1 ppm.

22. The ceramic film of claim 18, wherein said metal content is less than 100 ppb.

23. The ceramic film of claim 18, having a porosity of about 50% to about 80%.

24. The ceramic film of claim 18, having a porosity of about 55% to about 75%.

25. The ceramic film of claim 18, wherein said film includes pores sufficiently ordered in a plane of the substrate that an X-ray diffraction pattern of said film shows a Bragg diffraction at a d spacing greater than about 44 Å.

26. The ceramic film of claim 18, wherein said film does not include pores sufficiently ordered in a plane of the substrate such that an X-ray diffraction pattern of said film shows a Bragg diffraction.